Topic: Focused science topics for Strategic Goal 3 (Near Earth Radiation): Toward combined models of acceleration, loss and transport of energetic electrons and protons in the magnetosphere

Project Title:
Duskside Relativistic Electron Precipitation (DREP) Events and Outer Belt Electron Losses

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Project Information:
Understanding the Earth's radiation belts requires understanding of the ways energetic particles are lost as well as the ways they are accelerated to high energies in the first place. The most significant radiation belt particles in terms of their danger to astronauts and robotic probes are the highly relativistic electrons in the outer radiation belt. We propose an in-depth study of the loss of these electrons to the Earth's atmosphere, concentrating particularly on a seldom-studied phenomenon we call Duskside Relativistic Electron Precipitation (DREP). DREP has been reported in a few cases using spacecraft, but has not been considered a dominant loss mechanism from these results. Data from balloons, however, suggest that DREP actually is the dominant mechanism for the loss of high-energy electrons from the outer belt.

Using archival data from the SAMPEX satellite, we will search for DREP events, characterize the differences between them and other sorts of precipitation, and quantify the time-averaged loss rates due to the DREP mechanism. SAMPEX data are particularly good for this study, since the satellite carried large detectors in a favorable orbit for 12 years of operations. With this study we will reconcile the historical balloon and satellite data, explore plasma physics in the magnetosphere (DREP are thought to be caused by electromagnetic ion cyclotron waves, or EMIC) and better understand the balance between loss and acceleration in the outer belts and the cause of their extreme variability.

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